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Tracking the trends 2024

Navigating global challenges and opportunities in mining and metals

Introduction

Navigating global challenges and opportunities in mining and metals

As we enter 2024, the mining and metals industry finds itself at the center of a complex matrix of challenges and opportunities, expectations, and demands.

With supply shortages looming in metals that are critical, not just to the energy transition but to global urbanization and industrialization, stakeholders are acting strategically to secure their supply chains (copper, for instance, is expected to see a supply deficit of 9.9Mt by 2035¹). With supply source alternatives such as urban mining still in their infancy, downstream companies and even governments are striking deals with miners and metals providers in a reshuffle that has seen some traditional value chains realign over the past 12 months.

Organizations also remain under pressure to improve the efficiency of existing assets and operations by embracing generative artificial intelligence (gen AI), leveraging third party delivery models with specialized back office capabilities and to unlock new value in assets. Additionally, the need for mining and metals companies to collaborate with industry peers, suppliers, and competitors to tackle productivity and environmental issues, all while upholding environmental, social, and governance (ESG) expectations in day-to-day operations remains a priority.

With strong business strategies in place and 2050 sustainability targets as its North Star, now is the time for the mining and metals industry to accelerate growth. However, with heightened uncertainty in the global geopolitical sphere and volatility in commodity markets, to do so may not be easy. Companies that navigate uncertainty, work with governments to address permitting issues for new projects, rethink the strategic value of exploration, work with regional players to address skills shortages, and drive toward becoming more purpose-led organizations are most likely to prevail.

In this, the 16th edition of Deloitte Global's *Tracking the trends*, a team of professionals from around the world provides insights and examples as well as practical ideas to help mining and metals companies rise to the challenges that lie ahead and capitalize on new opportunities. We're looking forward to discussing these trends with you in more depth and helping your organization to continue forging its own pathway to success. Thank you for your ongoing support.

Endnotes

1. Camellia Moors and Kip Keen, "[Looming copper shortage shifts attention to alternative supply solutions](#)," S&P Global Market Intelligence, 7 September 2022.



Trend 8

Unlocking new value in existing assets: Balancing complex priorities and meeting supply demand through operational optimization

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As demand for metals and minerals soars, fueled by a burgeoning global population,¹ record levels of urban development² and impending decarbonization targets in key economies, mining and metals companies are under increasing pressure to bring new supplies online. In addition to speeding up new developments to counteract potential supply shortages, organizations are focusing their efforts on extracting greater value from existing assets.

Operational efficiency and productivity improvement initiatives are two ways to do this. These were already front-of-mind for mining and metals companies, which have, for years now, faced declining ore grades and rising operating costs; in 2022, the 40 leading mining companies had operating expenses of US\$670 billion—an increase of 5.5% over the previous year.³

Today, data-led insights and digital technologies are enabling companies to balance complex and, sometimes, conflicting interests while meeting supply imperatives. The combination of operational technologies (OT), advanced visualization, and analytical tools are revolutionizing decision-making and changing the approach in long-standing functions, such as mine planning and maintenance, while also improving operational metrics. In this trend, we'll explore how organizations can use these techniques and technologies to enhance their operational productivity and efficiency.

Establishing a solid data foundation

As mining companies automate, electrify and connect ever more devices, applications and machines, there is a proliferation of data across the value chain. For example, in 2018, Rio Tinto's Iron-Ore operations, which, at the time, included 16 mines, 1,500km of rail and three ports, created 2.4 terabytes of data every minute from mobile equipment and sensors.⁴ This number would likely be much higher today. However, despite mining and metals companies having a wealth of data, most of it is not properly collected, contextualized, normalized, stored or analyzed, and therefore cannot always be reliably used in decision-making.

To address data value leakage requires a back-to-basics approach, establishing a solid foundation with a comprehensive data model that's well-defined and understood by parties across each organization's value chain. Architectural approaches such as creating a unified namespace (the practice of integrating consistent naming conventions across systems and applications in an organization)⁵ are gaining in popularity. These serve as methods for organizing data to reflect both the structure and current state of an entire enterprise.

One foundational area where mining and metals companies are focusing time and effort in the pursuit of predictive and prescriptive maintenance ambitions is in the asset master data and metadata domain of their enterprise resource planning (ERP) or enterprise asset management (EAM) solutions. Technical object structures (or equipment hierarchies) and damage and cause codes describing failures are critical in helping ensure that equipment failures are not only documented against the right equipment, but also captured accurately. This helps to establish a trusted data set that enables both reliability engineers and more sophisticated analytics to improve asset performance.

Harnessing tech-assisted decision-making

Most operational optimization programs in mining and metals to date have centered on achieving incremental productivity and safety gains and/or cost reductions in certain processes and functions. However, with a solid data foundation in place, companies can use a more sophisticated and integrated approach to address the wide-ranging requirements and constraints that they face today.

“If we take the example of a concentrator, asset performance has traditionally been measured by recovery, which is primarily constrained by throughput, and that has guided strategy and decision-making for these operations. However, in the future, the need to report each asset's carbon footprint and balance that against traditional productivity and profitability measures could lead to conflicting priorities on how best to operate the asset.”

Shak Parran, Ecosystems & Alliances leader, Energy, Resources & Industrials, Deloitte Canada

For example, by leveraging OT to gather information relating to physical assets—such as a mill, truck or smelter—and contextualizing that data, companies can re-create those assets as well as their inputs and outputs in the digital world (i.e., a “Digital Twin”). This allows the asset, processes, and systems surrounding them to be visualized and simulated, enabling better predictability of performance and possible future failures.

Simulation has been used for some time in mining and metals, although its applications are expanding. Its primary use is in validating the feasibility of new designs and concepts and to model changes to processes and operations over time. Companies can use simulations in advance of starting new projects or making changes, both big and small, to see whether the long-term gains could outweigh any short-term costs or production losses before finalizing their choices.⁶

Increasingly, simulation is being used with mathematical optimization tools to find the best possible solution to a problem given a business’ objectives and operational constraints. For example, Australian data science specialist PETRA recently helped an iron-ore operation in Western Australia to achieve a 5.5% improvement in plant throughput by optimizing the drill-and-blast phase of its operation. Data fusion ore tracking was used to create digital twins that correlated crusher downtime with geology and drill-and-blast designs. The program resulted in an estimated annual financial benefit of more than AU\$450 million (approximately US\$285 million).⁷

Agility through automated decision-making

Both simulation and optimization can be deployed strategically, tactically, and operationally to determine which investment, scenario, or process is most likely to deliver the greatest value across different time horizons.⁸ Advances in software packages and computer processing capacity mean that simulations that used to take days or weeks to run can now be completed within minutes, leading to new opportunities and applications.

Another of these is automated decision-making, for example, in functions such as mine planning. This concept is still relatively nascent in mining and metals, but it can ultimately make for more agile and adaptive operations.

Another area where automated decision-making could prove useful is in predictive maintenance of equipment. This is high on the priority list of many mining and metals companies; a 2023 survey by GlobalData revealed that, 68% of mines had made moderate investments into predictive maintenance for mobile equipment, 40% expected to either invest in the technology for the first time or invest further over the next two years.⁹

Maintenance costs typically represent 1-3% of total annual revenues for mining and metals companies,¹⁰ so even small savings in this area can deliver significant bottom-line savings, in addition to minimizing hazardous hands-on work for their technicians.

“Predictive maintenance has proven difficult for many companies because it’s an approach that’s based on statistics (which requires high quality data) and it changes the paradigm of how miners run and maintain equipment. It also requires companies to excel at some foundational practices, such as up to date asset master data, metadata and strong EAM work management discipline in areas like failure data collection, which few companies have achieved to date.”

Herman Lombard, partner, Industrial Smart Operations leader, Deloitte Canada

Many companies struggle to optimize maintenance practices because they want to both increase uptime and reduce operating costs. Using automated decision-making is a departure from the traditional engineering mindset given its statistical nature and requires a cultural shift; however, over time, it has the potential to deliver positive outcomes for businesses, given their objectives. Demonstrating this could help teams to work more harmoniously and help companies grow their trust in data.

Moving from reactive to proactive maintenance

Tata Steel, which began its digital transformation journey in 2016, is taking its maintenance approach a step further. Through its Shikhar 25 transformation initiative, the company is creating digital twins for all its critical and complex processes, including mines, factories, and blast furnaces. Once in place, these will help the company to move from a predictive maintenance approach to a prescriptive one, which is expected to lead to greater efficiencies, fewer breakdowns, and lower costs.¹¹

Prescriptive maintenance is an asset maintenance strategy that uses machine learning to adjust operating conditions for desired outcomes, as well as intelligently scheduling and planning asset maintenance.¹² This is a step-up from predictive maintenance and represents a shift from reactive to proactive asset performance management. If organizations can contextualize and standardize their data, then there could be more opportunities to tackle rising operational expenditures through reduced maintenance and parts costs, and they could expect to deliver greater safety performance.

For example, a multinational mining company recently implemented the Aspen Mtell machine learning solution from AspenTech and was able to improve its production uptime. AspenTech said the customer now uses its autonomous agents for early warnings of degradation in metals refining processes and equipment. These regularly advise a time-to-failure of around 40 days on pumps.¹³

Turning information into competitive insights

Due to technological advances and digitization, mining and metals companies have access to more valuable data than ever before.¹⁴ Making greater use of widely available tools, such as simulation and mathematical optimization, could turn information into a significant business advantage by driving more predictable operational outcomes, saving money and improving operational safety and sustainability. In turn, these practices can be expected to help satisfy wide-ranging stakeholder expectations and bring new supply online for future-critical metals and minerals.

From ideas to actions

- **Establish a solid data foundation:** Invest in the development of a data model and data dictionary for your organization to help ensure that data is understood and can be collected, contextualized, normalized and used in reporting, simulation, analytics and, finally, decision-making.
- **Look for easy-to-implement advances:** Find a small, high return-on-investment (ROI) use case to implement as a minimal viable product. Starting in this way can help build experience and confidence within teams and deliver tangible benefits that can be used to develop larger business cases.
- **Buy rather than build:** Many software-based simulation and optimization programs are available for different mining and metals applications. Today, use of the cloud means that these programs can often be deployed relatively quickly and inexpensively to address operational bottlenecks.
- **Scale current applications:** Explore whether data and digital technologies for assisted decision-making could be expanded across other business operations and functions for maximum ROI.
- **Consider outsourcing data preparation:** High-quality data is essential for accurate simulation and optimization. Assess the state of the data and, if preparation work is necessary, consider whether there are resources to handle it internally. Outsourcing to a team of specialist data scientists could prove to be a faster and more cost-effective option in the short term until internal teams develop the requisite knowledge, skills, and abilities.
- **Appoint a chief data officer (CDO):** The data held by mining companies can be of tremendous value. Appointing a CDO to manage data with appropriate risk, governance and control mechanisms could improve OT usage.

Endnotes

1. United Nations (UN), [Global issues: Population](#), accessed 2 November 2023.
2. The World Bank, [Urban Development: Overview](#), last updated 3 April 2023.
3. M. Garside, "Total operating expenses of the top mining companies worldwide from 2005 to 2022, with a forecast for 2023," Statista, 16 June 2023.
4. Bernard Marr, "How Mining Companies Are Using AI, Machine Learning And Robots," Forbes, 7 September 2018.
5. Sergey Koreshkov, "Unified Namespace Part 1: A digital transformation must-have," Nukon, 18 April 2023.
6. Carly Leonida, "Making the most of autonomous mining systems," Polymathian, 2023.
7. PETRA, "More than 5.5% overall lift plant throughput in an iron ore operation in WA," accessed 5 October 2023.
8. Carly Leonida, "Calculating the most efficient pathways to net zero mines," Polymathian, 2022.
9. Mining Technology, "Predictive maintenance for mobile equipment expected to be a key focus for investment in the next two years," 9 May 2023.
10. Alexander Hill, "The power of smart PdM in metals and mining," Global Mining Review, 8 June 2022.
11. Abhishek Mande-Bhot, "Redefining the future of steelmaking," Tata Steel, November 2020.
12. AspenTech, "Prescriptive maintenance," accessed 6 October 2023.
13. Robert Golightly, "Prescriptive maintenance: Transforming asset performance management," AspenTech, 2023.
14. Greg Johnson and Yong The, "How to optimize the mining value chain with digitally integrated power and process operations," Schneider Electric, 24 May 2022.

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